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Introduction

A widespread disease of shortleaf pine trees (P. echinata Mill.) in the Southeast has attracted the attention of foresters and owners of timberland in recent years. It was first reported in 1935 from Tallapoosa County, Ala., by Mr. D. J. Weddell[3/], who also made the first report from Georgia in 1939. There is good evidence that this disease has been present for a number of years in northwestern Alabama.

At first the disease did not seem particularly significant. However, in the spring of 1939 the attention of pathologists of the Bureau of Plant Industry was called to a stand in the vicinity of Plantersville, Ala., where numerous mature 3-log shortleaf pine trees were found to be slowly dying from some obscure cause. Scouting has now shown the same trouble in varying stages at other places. Trees 4 inches in diameter at breast height and larger were found affected. As paucity of foliage and unusually short needles are constant symptoms of the disease, it has been named "little-leaf." Although loblolly pine (P. taeda L.) is also affected, this disease occurs principally on shortleaf pine.

In areas where the disease has been present long enough to kill a considerable number of trees, the proportion of the survivors showing disease symptoms is often very high. In an even-aged pine stand, a tally showed 32 living shortleaf pines and 15 dead standing trees on 1/2 acre. Of the former, 25 showed symptoms of the disease. About a quarter of a mile away, in a younger stand of shortleaf pine where the dominants were 20-30 years old, a tally showed 5 dead trees, 76 with disease symptoms, and 57 apparently healthy trees on 3/8 acre.

The progress of the little-leaf disease in a stand of timber is characteristically sporadic and unlike that caused by other killing agencies. While trees with the little-leaf disease usually are found in groups, affected trees drop out of the stand as individuals; and dead, dying, and apparently healthy trees may be intermingled in the same group (fig. 1-B,D). Furthermore, little-leaf symptoms do not appear until trees are about 20 or more years old.

1/ Forest Pathology 40-38.

2/ For advice or assistance in this investigation, the writers wish to express their appreciation to Prof. L. M. Ware, Alabama Polytechnic Institute, and Mr. R. H. Page, Jr., Extension Forester, Auburn, Ala.; Mr. G. D. Evans, Forester, Alabama Power Co., Birmingham; Mr. C. J. Calloway, Hamilton, Ga.; and Mr. R. H. Erkel, Soil Conservation Service, Cullman, Ala.

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FIGURE 1

LITTLE-LEAF DISEASE OF SHORTLEAF PINE

A. Dominant shortleaf pine, showing characteristic symptoms of the little-leaf disease.

B. Shortleaf pine stand with most of the trees showing symptoms of the disease.

C. Apparently healthy and diseased shortleaf pines growing side by side. Note development of suckers along the larger branches.

D. Longleaf pine surviving among dead and dying shortleaf pines, indicating that it is more resistant.

Fig. 1. Little-leaf disease of shortleaf pine. For explanatory legend, see opposite page.

This paper has been prepared in order to call attention to the disease and to summarize for foresters and timberland owners the information now available concerning it.

Relative Susceptibility

Shortleaf pine is much more susceptible to the little-leaf disease than other southern pines, as indicated by the greater prevalence of the disease on shortleaf admixed with other species of pine. In one stand, for instance, 50 of 108 shortleaf pines and 4 of 40 loblolly pines showed symptoms of the disease. Although definite little-leaf symptoms have not been found on longleaf pine (P. palustris Mill.), it must not be concluded that this species is immune to the disease. The survival of longleaf pine, however, in places where associated species have been killed by the disease (fig. 1-D), indicates that longleaf pine, if susceptible, is the least so of the three species studied.

Symptoms

As yet there has been no opportunity to trace the progress of the disease chronologically from its initial stages on individual trees. In the following description, which is based on observations on shortleaf pine in several localities where all stages of the disease occur, the various symptoms are given as they are believed to appear in sequence, but the time factor is still unknown.

The first symptom of the little-leaf disease is a uniform thinning of the foliage, caused by premature shedding of part of the needles of the second and third growing seasons. Usually this condition is followed by death of the branches (fig. 1-A), starting with those nearest the ground. Needle color turns from green to light greenish yellow, with the yellowing apparently intensified as the season advances. Needle length is reduced until the average length of needle on diseased trees is about half that of the foliage on healthy trees growing under similar environmental conditions. Dieback of branch terminals is common. Occasionally, suckers arising from adventitious buds give a feathered appearance to the larger branches (fig. 1-C). During the final stages of the disease, the scanty, chlorotic, and unusually short foliage is confined to wood of the current season's growth.

Disease symptoms vary somewhat, probably depending on the species of pine. The foliage of badly diseased loblolly pines, for example, is appreciably greener than that of diseased shortleaf pines growing on the same site.

The roots of pine trees attacked by the little-leaf disease have been found consistently defective. The finer roots on the laterals are often dead and break off readily in the soil while being excavated. Most of the larger roots are alive, but cross sections show shallow, cortical lesions extending into the living phloem almost to the cambium. Resin ducts in the wood of the larger roots are often stained reddish brown. Black, sooty masses composed of soil and oxidized resin, bound together by dark fungus strands, are sometimes found adhering to the bark of freshly extracted roots; the woody parts of the roots covered by these masses are so heavily infiltrated with resin as to appear water-soaked.

In a study of recent radial growth, based on approximately 50 increment cores from diseased and healthy trees in several localities, about two-thirds of the diseased trees showed a very sharp reduction in growth, starting 2 to 16 years ago. The remaining one-third showed a gradual reduction in radial growth that gave no indication when the disease had started. Radial growth of healthy trees, on the other hand, showed either a gradual reduction for many years or no reduction, depending on the relative age of the tree sampled, but 2 of 19 apparently healthy trees showed a sharp reduction in radial growth, starting 3 and 6 years ago. It is possible that some of the trees now thrifty have had the disease and have recovered.

Distribution

Surveys between August 1939 and the last of June 1940 showed the little-leaf disease to be distributed (see fig. 2) from the vicinity of Shelby, N. C., south and southwestward through the Piedmont in South Carolina, Georgia, and Alabama. West and northwest of the Piedmont, in Alabama, the disease is distributed in a zone about 75 miles wide, paralleling the Black Prairie on the north. Its western limit, as now known, is in eastern Itawamba County, in northeastern Mississippi. Since the map was prepared the disease has also been reported in south central Virginia.

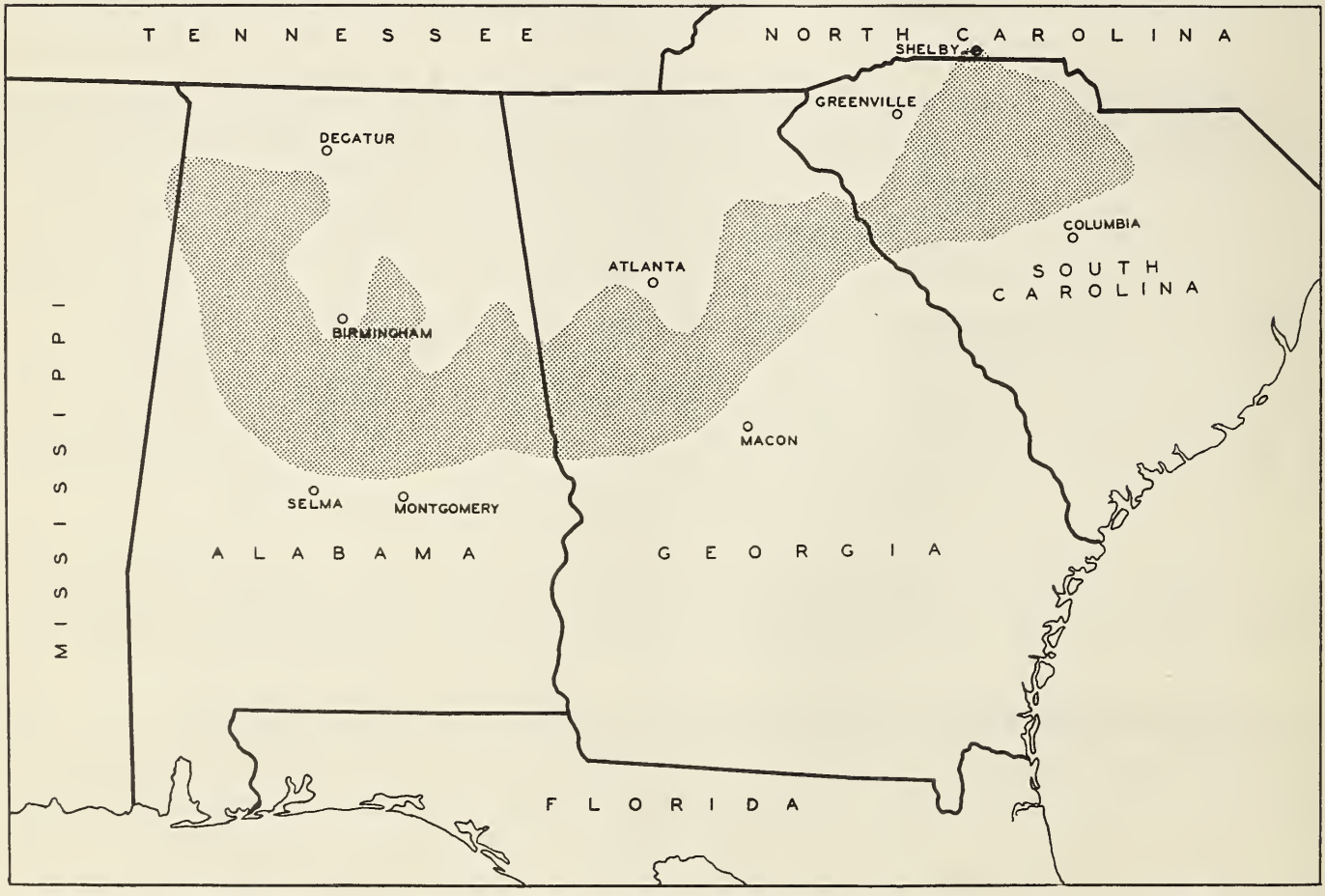

FIGURE 2.- DISTRIBUTION OF THE LITTLE-LEAF DISEASE OF PINES IN THE SOUTHEASTERN STATES AS DETERMINED BY ROADSIDE SURVEYS BETWEEN AUGUST 7, 1939 AND JUNE 18, 1940.

Theories as to Cause

The cause of the little-leaf disease has not yet been determined. A number of theories have been proposed, but there seem to be strong arguments against any one of them alone. The abrupt drop in radial growth, usually several years before death, characteristic of most little-leaf trees, and the contrasting good health of associated loblolly and longleaf pines argue against nutritional disturbance as a causative factor. These observations, together with the fact that precipitation has been about normal for the last 7 or 8 years over most of the little-leaf belt, suggest that this disease is not due simply to lack of water. Drought occurred in 1924-25 and in the early thirties, but the disease has increased appreciably during the last 4 or 5 years. The temperatures during recent years have been consistently slightly above normal. Just how this might bring about little-leaf seems obscure. The disease might be caused by a virus, but no virus disease of conifers is known, and this possibility also seems remote because symptoms do not appear until the trees are close to 20 years old. Root parasitism might account for little-leaf, but the presence of healthy seedlings and saplings in the immediate vicinity of diseased trees argues against the existence of a virulent soil-inhabiting organism. Without marshaling all of the arguments for and against the theories on the cause of little-leaf, it suffices to say that at present it appears that no single factor is responsible for the disease.

Summary

A gradual but widespread dying of pine trees due to unknown causes has been found in the Southeastern States. Deterioration of the feeding roots is involved. The main symptoms of the disease above ground are (1) premature loss of foliage, (2) death of branches, starting with those closest to the ground, and (3) persistence on the twigs of short, yellowish needles of the current growing season.

Little-leaf disease is distributed, in the main, in a crescent-shaped area, 50 to 75 miles in width, extending through the southern part of the commercial range of shortleaf pine in South Carolina, Georgia, and Alabama. Its northern extension, recently found in south central Virginia, is not shown on the map (fig. 2).

Observations in mixed stands of native pines indicate that shortleaf is the most susceptible species and that loblolly pine is much less affected. No longleaf pines have been seen with definite symptoms of the disease.

Note: Assistance in the preparation of these materials was furnished by the personnel of Work Projects Administration, Official Project No. 65-2-64-74.